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APPLICATION NO.	FILING DATE	FIRST NAMED INVENTOR	ATTORNEY DOCKET NO.	CONFIRMATION NO.
09/588,008	06/06/2000	Sam Yang	M4065.0210/P210	9015

24998 7590 10/13/2005

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EXAMINER	
TRINH, HOA B	

ART UNIT	PAPER NUMBER
2814	

DATE MAILED: 10/13/2005

Please find below and/or attached an Office communication concerning this application or proceeding.

EK

Office Action Summary	Application No.	Applicant(s)	
	09/588,008	YANG ET AL.	
	Examiner	Art Unit	
	Vikki H. Trinh	2814	

-- The MAILING DATE of this communication appears on the cover sheet with the correspondence address --

Period for Reply

A SHORTENED STATUTORY PERIOD FOR REPLY IS SET TO EXPIRE 3 MONTH(S) FROM THE MAILING DATE OF THIS COMMUNICATION.

- Extensions of time may be available under the provisions of 37 CFR 1.136(a). In no event, however, may a reply be timely filed after SIX (6) MONTHS from the mailing date of this communication.
- If the period for reply specified above is less than thirty (30) days, a reply within the statutory minimum of thirty (30) days will be considered timely.
- If NO period for reply is specified above, the maximum statutory period will apply and will expire SIX (6) MONTHS from the mailing date of this communication.
- Failure to reply within the set or extended period for reply will, by statute, cause the application to become ABANDONED (35 U.S.C. § 133).
- Any reply received by the Office later than three months after the mailing date of this communication, even if timely filed, may reduce any earned patent term adjustment. See 37 CFR 1.704(b).

Status

1)☒ Responsive to communication(s) filed on *25 July 2005* .

2a)☒ This action is **FINAL**. 2b)☐ This action is non-final.

3)☐ Since this application is in condition for allowance except for formal matters, prosecution as to the merits is closed in accordance with the practice under *Ex parte Quayle*, 1935 C.D. 11, 453 O.G. 213.

Disposition of Claims

4)☒ Claim(s) *1-31 and 99* is/are pending in the application.

4a) Of the above claim(s) _____ is/are withdrawn from consideration.

5)☐ Claim(s) _____ is/are allowed.

6)☒ Claim(s) *1-31,99* is/are rejected.

7)☐ Claim(s) _____ is/are objected to.

8)☐ Claim(s) _____ are subject to restriction and/or election requirement.

Application Papers

9)☐ The specification is objected to by the Examiner.

10)☒ The drawing(s) filed on *10 January 2001* is/are: a)☒ accepted or b)☐ objected to by the Examiner.

Applicant may not request that any objection to the drawing(s) be held in abeyance. See 37 CFR 1.85(a).

11)☐ The proposed drawing correction filed on _____ is: a)☐ approved b)☐ disapproved by the Examiner.

If approved, corrected drawings are required in reply to this Office action.

12)☐ The oath or declaration is objected to by the Examiner.

Priority under 35 U.S.C. §§ 119 and 120

13)☐ Acknowledgment is made of a claim for foreign priority under 35 U.S.C. § 119(a)-(d) or (f).

a)☐ All b)☐ Some * c)☐ None of:

1.☐ Certified copies of the priority documents have been received.

2.☐ Certified copies of the priority documents have been received in Application No. _____ .

3.☐ Copies of the certified copies of the priority documents have been received in this National Stage application from the International Bureau (PCT Rule 17.2(a)).

* See the attached detailed Office action for a list of the certified copies not received.

14)☐ Acknowledgment is made of a claim for domestic priority under 35 U.S.C. § 119(e) (to a provisional application).

a) ☐ The translation of the foreign language provisional application has been received.

15)☐ Acknowledgment is made of a claim for domestic priority under 35 U.S.C. §§ 120 and/or 121.

Attachment(s)

1) ☒ Notice of References Cited (PTO-892)
2) ☐ Notice of Draftsperson's Patent Drawing Review (PTO-948)
3) ☐ Information Disclosure Statement(s) (PTO-1449) Paper No(s) _____ .
4) ☐ Interview Summary (PTO-413) Paper No(s). _____ .
5) ☐ Notice of Informal Patent Application (PTO-152)
6) ☐ Other:

DETAILED ACTION

Claim Rejections - 35 USC § 112

1. The following is a quotation of the first paragraph of 35 U.S.C. 112:

> The specification shall contain a written description of the invention, and of the manner and process of making and using it, in such full, clear, concise, and exact terms as to enable any person skilled in the art to which it pertains, or with which it is most nearly connected, to make and use the same and shall set forth the best mode contemplated by the inventor of carrying out his invention.

2. Claim 99 is rejected under 35 U.S.C. 112, first paragraph, as failing to comply with the written description requirement. The claim(s) contains subject matter which was not described in the specification in such a way as to reasonably convey to one skilled in the relevant art that the inventor(s), at the time the application was filed, had possession of the claimed invention. In claim 97, line 7, the top electrode comprising "a bottom and a top conducting layer" is not described in the original specification.

Claim Objections

3. Claims 21-22 are objected to because of the following informalities: In claim 22, line 2, and in claim 22, line 3, a colon ":" should be deleted; and in line 3 of claim 21 and line 4 of claim 22, a comma "," should be inserted before the term "and". Appropriate correction is required.

Claim Rejections - 35 USC § 102

1. The following is a quotation of the appropriate paragraphs of 35 U.S.C. 102 that form the basis for the rejections under this section made in this Office action:

> A person shall be entitled to a patent unless –
>
> (e) the invention was described in (1) an application for patent, published under section 122(b), by another filed in the United States before the invention by the applicant for patent or (2) a patent granted on an application for patent by another filed in the United States before the invention by the applicant for patent, except that an international application filed under the treaty defined in section 351(a) shall have the effects for purposes of this subsection of an application filed in the United States only if the international application designated the United States and was published under Article 21(2) of such treaty in the English language.

2. Claims 1-3, 7-16, 18-25, 29-31 are rejected under 35 U.S.C. 102(e) as being anticipated by Iizuka (6,338,996).

With respect to claim 1, Iizuka discloses a capacitor in a semiconductor device having a bottom conducting layer 28 (fig. 1), wherein the bottom conducting layer 28 forms a bottom electrode (col. 3, lines 35-40); a dielectric layer 30 (fig. 1) over the bottom conducting layer 28; and a top electrode 32 (fig. 1) that consists of a single top conducting layer (fig. 1) over the dielectric layer 30; the single top conducting layer of the top electrode 32 is an oxidizing gas annealed (col. Col. 5, lines 20-25) layer. Note that "oxidizing gas anneal" is an anneal performed in a gas mixture with oxygen concentration.

As to claim 2, Iizuka discloses that the bottom conducting layer 28 (fig. 1) is formed of a material selected from the noble metal group (col. 3, lines 38-40).

As to claim 3, Iizuka discloses that the bottom conducting layer is formed of a metal (col. 3, lines 38-40).

As to claims 7-8, Iizuka discloses that the bottom conducting layer is formed from material such as platinum (Pt) and Ruthenium (Ru). (col. 3, lines 38-40).

As to claim 9, Iizuka discloses that the capacitor is formed over a conductive plug 18 (fig. 1) or 21 (fig. 2b), and further includes depositing an oxygen barrier 24 or 26 (fig. 1) over the plug 18 or 21 (fig. 1 or fig. 2b) prior to forming the bottom conducting layer 28 (fig. 1).

As to claim 10, Iizuka discloses that the dielectric layer is a dielectric metal oxide layer (col. 3, lines 40-42).

As to claim 11, Iizuka discloses that the dielectric layer has a high dielectric constant that falls within the range as claimed. (e.g. BST, Col. 3, lines 40-42).

As to claims 12-13, Iizuka discloses that the dielectric layer 30 (fig. 1) is formed of a material such as BST. (Col. 3, lines 40-42).

As to claim 14, Iizuka teaches that the dielectric layer 30 (fig. 1) is heated to a temperature above 200 degrees Celsius (col. 4, lines 59-60) to change it to a crystallized dielectric layer 30 from an original material that may be an amorphous material (col. 4, lines 55-63, col. 1, lines 30-33).

As to claim 15, Iizuka discloses that the top conducting layer 32 (fig. 1) is formed of a material selected from the noble metal group (col. 3, lines 38-40).

As to claim 16, Iizuka discloses that the top conducting layer 32 is formed of a non-oxidizing metal permeable to oxygen (col. 3, lines 38-40).

As to claims 18-19, 22, Iizuka discloses that the top conducting layer 32 (fig. 1) is formed from material such as platinum (Pt) and Ruthenium (Ru). (col. 3, lines 38-40).

As to claims 20-21, Iizuka discloses that the top and bottom conducting layers 32, 28 (fig. 1) are formed of a material such as platinum (col. 3, lines 38-40) and the dielectric layer 30 (fig. 1) is a BST (col. 3, lines 40-42).

As to claim 23-25, Iizuka discloses that the top conducting layer 32 is annealed with a gas mixture having oxygen compound (col. 5, lines 20-25).

As to claim 29, Iizuka teaches the capacitor is a stacked capacitor (fig. 1).

As to claim 30, the capacitor (fig. 1) further comprises an access transistor (fig. 1) connected to the capacitor (fig. 1).

As to claim 31, the capacitor may be a DRAM (fig. 1).

Claim Rejections - 35 USC § 103

3. The following is a quotation of 35 U.S.C. 103(a) which forms the basis for all obviousness rejections set forth in this Office action:

> (a) A patent may not be obtained though the invention is not identically disclosed or described as set forth in section 102 of this title, if the differences between the subject matter sought to be patented and the prior art are such that the subject matter as a whole would have been obvious at the time the invention was made to a person having ordinary skill in the art to which said subject matter pertains. Patentability shall not be negatived by the manner in which the invention was made.

4. This application currently names joint inventors. In considering patentability of the claims under 35 U.S.C. 103(a), the examiner presumes that the subject matter of the various claims was commonly owned at the time any inventions covered therein were made absent any evidence to the contrary. Applicant is advised of the obligation under 37 CFR 1.56 to point out the inventor and invention dates of each claim that was not commonly owned at the time a later invention was made in order for the examiner to consider the applicability of 35 U.S.C. 103(c) and potential 35 U.S.C. 102(e), (f) or (g) prior art under 35 U.S.C. 103(a).

5. Claims 4-5 and 17 are rejected under 35 U.S.C. 103(a) as being unpatentable over Iizuka, as applied to claim 32, in view of Emesh et al. (5,452,178) (hereinafter Emesh).

Iizuka discloses the invention substantially as claimed. However, Iizuka does not explicitly state that the bottom conducting layer may be formed of a metal alloy or conducting metal oxide, and that the top conducting layer is formed of a conducting metal oxide.

Emesh discloses an analogous method and device having a bottom electrode 54 (fig. 3), a dielectric 60, 64 (fig. 3) , and a top electrode 68 (fig. 3) , wherein the bottom electrode 54 (fig. 3) may be formed of conductive metal alloy, or conductive metal oxide (col. 7, lines 1-2). The top electrode 68 may be formed of conducting metal oxide (col. 9, lines 40-42).

Therefore, as to claims 4-5, it would have been obvious to one of ordinary skill in the art at the time the invention was made to modify the bottom electrode of Iizuka with the metal alloy or conductive metal oxide material, as taught by Emesh, so as to provide an alternative material to make the bottom electrode.

As to claim 17, it would have been obvious to one of ordinary skill in the art at the time the invention was made to modify the invention of Iizuka with the top electrode made of conductive metal oxide, as taught by Emesh, so as to provide an alternative material to make the top electrode.

6. Claims 6, 14 are rejected under 35 U.S.C. 103(a) as being unpatentable over Iizuka, as applied to claim 32, in view of Alers (6,303,426).

Iizuka discloses the invention substantially as claimed. In particular, Iizuka discloses that the top conducting layer 32 (fig. 1) is formed of platinum (Pt). However, Iizuka does not explicitly state that the bottom conducting layer may be formed of a metal nitride and the dielectric layer may be formed of a Tantalum oxide (TaO) and is crystalline or amorphous material.

Alers discloses an analogous method and device having a bottom electrode 66 (fig. 3) , a dielectric layer 70 (fig. 3), and a top electrode 80 (fig. 3), wherein the bottom electrode 66 is made of metal nitride material (col. 3, lines 53-54) and the dielectric layer 70 is formed of Tantalum Oxide (TaO) and is either crystalline or amorphous (col. 3, lines 58-65) .

Therefore, as to claim 6, it would have been obvious to one of ordinary skill in the art at the time the invention was made to modify the invention of Iizuka with the bottom electrode

made of metal nitride, as taught by Alers, so as to provide an alternative material for the bottom electrode.

As to claim 14, it would have been obvious to one of ordinary skill in the art at the time the invention was made to modify the invention of Iizuka with the dielectric layer made of Tantalum oxide (TaO), as taught by Alers, so as to provide an alternative material for the dielectric layer.

7. Claims 26-27 are rejected under 35 U.S.C. 102(e) as anticipated by or, in the alternative, under 35 U.S.C. 103(a) as obvious over Iizuka, as applied to claim 32, in view of Narwankar et al. (6,475,854) (hereinafter Narwankar).

Iizuka discloses the invention substantially as claimed. However, Iizuka does not explicitly disclose that the annealing step is a plasma enhanced annealing, a remote plasma enhanced annealing, or ultraviolet light enhanced annealing.

Narwankar discloses an analogous method and device having a bottom electrode 604 (fig. 6f) , a dielectric layer 606 (fig. 1), and a top electrode 610 (fig. 6f), wherein the top electrode 610 is annealed (col. 11, line 4-5) in an oxygen environment, thereby performing an oxidizing annealing step. The annealing is a plasma enhanced annealing, or remote plasma enhanced annealing (col. 13, lines 14-20) and that the annealing is done at a pressure of 2.5 Torr and performed at 2 minutes (col. 13, lines 10-15).

Therefore, as to claims 26-27, it would have been obvious to one of ordinary skill in the art at the time the invention was made to modify the invention of Iizuka with the annealing such as plasma enhanced annealing, or remote plasma enhanced annealing, as taught by Narwankar, so as to provide an alternative technique to anneal the top electrode.

Note: The patentability of a product does not depend on its method of production. If the product in the product-by-process claim is the same as or obvious from a product of the prior art, the claim is unpatentable even though the prior product was made by a different process. *In re Thorpe*, 777 F. 2d 695, 698, 227 USPQ 964, 966 (Fed. Cir. 1985).

8. Claim 28 is rejected under 35 U.S.C. 102(e) as anticipated by or, in the alternative, under 35 U.S.C. 103(a) as obvious over Iizuka, as applied to claim 32, in view of Marsh (6,387,802).

Iizuka discloses the invention substantially as claimed. In particular, Iizuka discloses the top electrode 32 made of platinum (Pt) (col. 3, lines 38-39). However, Iizuka does not explicitly teach that the annealing step of the top electrode is an ultraviolet light enhanced annealing.

Marsh discloses an analogous method and device having a bottom electrode 152 (fig. 11), a dielectric layer 153 (fig. 11), and a top electrode (col. 8, lines 30-35), wherein the top electrode is deposited and annealed (col. 2, lines 30-35) using ultraviolet light enhanced annealing in the same manner as the bottom electrode.

Therefore, as to claim 28, it would have been obvious to one of ordinary skill in the art at the time the invention was made to modify the annealing step of Iizuka with ultraviolet light enhanced annealing, as taught by Marsh, so as to provide an alternative technique to anneal the top electrode and to remove carbon in the platinum group metal of the top electrode (col. 2, lines 34-35).

Note: The patentability of a product does not depend on its method of production. If the product in the product-by-process claim is the same as or obvious from a product of the prior art, the claim is unpatentable even though the prior product was made by a different process. *In re Thorpe*, 777 F. 2d 695, 698, 227 USPQ 964, 966 (Fed. Cir. 1985).

9. Claim 99 is rejected under 35 U.S.C. 103(a) as being unpatentable over Iizuka in view of Emesh.

Iizuka discloses a method of forming a capacitor in a semiconductor device , the method including the steps of forming a bottom conducting layer 28 (fig. 1), wherein the bottom conducting layer 28 forms a bottom electrode (col. 3, lines 35-40); forming a dielectric layer 30 (fig. 1) over the bottom conducting layer 28; forming a top electrode 32 (fig. 1) over the dielectric layer 30; and annealing the top conducting layer of the top electrode 32 with an oxidizing gas anneal (col. Col. 5, lines 20-25). Note that "oxidizing gas anneal" is an anneal performed in a gas mixture with oxygen concentration.

However, Iizuka does not explicitly teach that the top electrode may be formed of a multilayer with a bottom and a top conducting layer.

Emesh discloses an analogous method and device having a bottom electrode 54 (fig. 3), a dielectric 60, 64 (fig. 3) , and a top electrode 68 (fig. 3) , wherein the dielectric layer 60, 64 is formed from material such as silicon dioxide (col. 8, line 40), PZT (col. 8, line 59), or Al_2O_3 (col. 9, line 27). The top electrode 68 may be formed of a multilayer structure. The multilayer top electrode has a bottom conducting layer, as a conductive barrier layer, and a top conducting layer (col. 9, lines 42-46), whereby the materials for the bottom and top conducting layer may be Pt/RuO2.

Therefore, as to claim 97, it would have been obvious to one of ordinary skill in the art at the time the invention was made to modify the top conducting layer of the top electrode of Iizuka to include a bottom conducting layer, as taught by Emesh, so as to provide an alternative multilayer structure for the top electrode (col. 9, lines 40-44).

Response to Arguments

10. Applicant's arguments with respect to the pending claims have been considered but are moot in view of the new ground(s) of rejection.

Conclusion

11. Applicant's amendment necessitated the new ground(s) of rejection presented in this Office action. Accordingly, **THIS ACTION IS MADE FINAL**. See MPEP § 706.07(a). Applicant is reminded of the extension of time policy as set forth in 37 CFR 1.136(a).

A shortened statutory period for reply to this final action is set to expire THREE MONTHS from the mailing date of this action. In the event a first reply is filed within TWO MONTHS of the mailing date of this final action and the advisory action is not mailed until after the end of the THREE-MONTH shortened statutory period, then the shortened statutory period will expire on the date the advisory action is mailed, and any extension fee pursuant to 37 CFR 1.136(a) will be calculated from the mailing date of the advisory action. In no event, however, will the statutory period for reply expire later than SIX MONTHS from the date of this final action.

The prior art made of record and not relied upon is considered pertinent to applicant's disclosure.

Gealy et al. '718 discloses a capacitor having a bottom electrode, a dielectric, and an upper electrode (see fig. 10).

Any inquiry concerning this communication or earlier communications from the Examiner should be directed to Vikki Trinh whose telephone number is (571) 272-1719. The Examiner can normally be reached from Monday-Friday, 9:00 AM - 5:30 PM Eastern Time. If

attempts to reach the examiner by telephone are unsuccessful, the Examiner's supervisor, Mr. Wael Fahmy, can be reached at (571) 272-1705. The office fax number is 703-872-9306.

Any request for information regarding to the status of an application may be obtained from the Patent Application Information Retrieval (PAIR) system. Also, status information for published applications may be obtained from either Private PAIR or Public Pair. In addition, status information for unpublished applications is available through Private PAIR only. For more information about the PAIR system, see http://pair-direct.uspro.gov. If you have questions pertaining to the Private PAIR system, please contact the Electronic Business Center (EBC) at 866-217-9197 (toll free).

Lastly, paper copies of cited U.S. patents and U.S. patent application publications will cease to be mailed to applicants with Office actions as of June 2004. Paper copies of foreign patents and non-patent literature will continue to be included with office actions. These cited U.S. patents and patent application publications are available for download via the Office's PAIR. As an alternate source, all U.S. patents and patent application publications are available on the USPTO web site (www.uspto.gov), from the Office of Public Records and from commercial sources. Applicants are referred to the Electronic Business Center (EBC) at http://www.uspto.gov/ebc/index.html or 1-866-217-9197 for information on this policy. Requests to restart a period for response due to a missing U.S. patent or patent application publications will not be granted.

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